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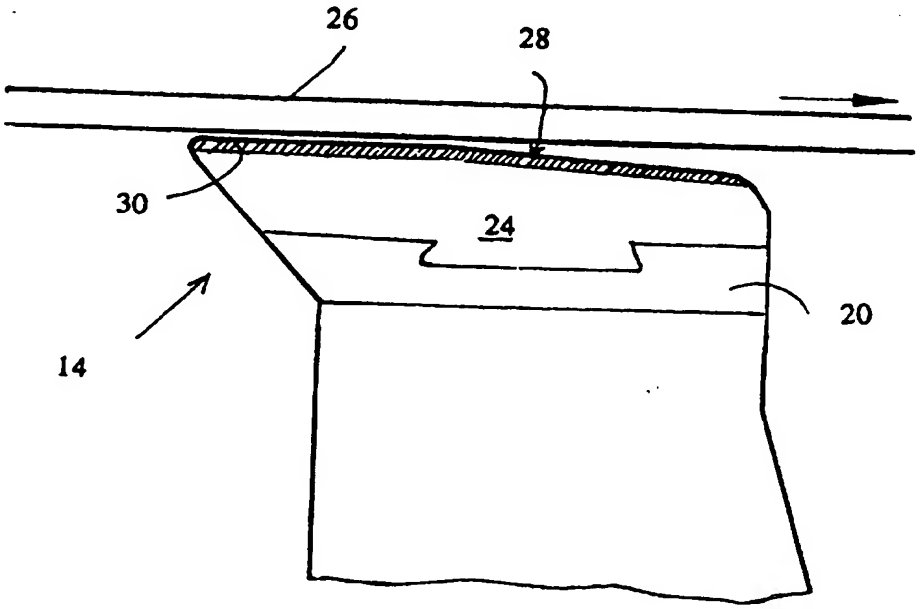
(54) Title: A WEARING ELEMENT, SUCH AS A FOIL OR A COVER OF A SUCTIONBOX IN A PAPER MACHINE WIRE SECTION

(57) Abstract

The invention relates to an element susceptible to wear, such as a foil or a vacuum box cover for a paper machine. The element is according to the invention made of a pressed, extruded or rolled aluminium profile (24). The aluminium profile is preferably coated at least partly with a surface layer (30) containing chromium oxide, aluminium oxide, zirconium oxide, aluminium silicate or carbides. The surface layer is achieved by means of electrolytic plasma oxidation or thermic spray coating, such as plasma spray coating or detonation spray coating. The invention renders it possible to manufacture foils and vacuum box covers cost-effectively.



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A wearing element, such as a foil or a cover of a suctionbox in a paper machine wire section

The present invention relates to an element susceptible to wear, such as a foil or a vacuum box cover for a paper machine.

The drainage on the wire of a paper machine is brought about by hydrodynamic pressure which is accomplished by drainage elements disposed below the wire, such as foils or vacuum boxes. The wire running on the foils and vacuum box covers abrades the upper surfaces of the foils and the vacuum boxes heavily.

The endurance of foils made of metal has been improved by providing the upper surfaces of the foils with special ceramic inserts or upper parts, as shown for instance in Finnish Patent Application No. 935600. Foils are also made of ceramic materials. These foil constructions are, however, very expensive.

It is the object of the present invention to provide an element susceptible to wear in a paper machine and a method of manufacturing it, in which the above problems are minimized. The object is in particular to provide an abrasion-resistant foil or the like the purchase price of which is advantageous. The above objects are achieved by the invention, which is characterized by the features according to the appended claims.

According to the invention, foils, vacuum box covers and corresponding drainage elements in the wire section are made of pressed or extruded aluminium profiles. Aluminium can easily be extruded into a desired profile and in lengths corresponding to the width of the wire.

According to an advantageous embodiment of the invention, the aluminium profiles are surface treated by means of

electrolytic plasma oxidation so that a layer of aluminium oxide, 50 - 400 μm thick, is deposited on the surface of the profile. The aluminium surface is thus electrolytically coated with a relatively thick layer of aluminium oxide, Al_2O_3. The oxide layer produced is hard, abrasion-resistant and forms protection against corrosion by passivating the surface of the profile.

Normal anodizing, anodical oxidation, of aluminium only produces an oxide layer having a thickness of 5 - 15 μm, which gives protection against corrosion and abrasion but does not substantially improve the hardness of the aluminium profile. An oxide layer thickness of 50 - 400 μm improves, however, the hardness of the aluminium profile considerably.

Electrolytic plasma oxidation is an environment friendly and energy-saving process. The aluminium profile, which, if necessary, is pretreated, pickled and degreased, is immersed in a weak alkalic electrolytic solution, preferably of 0,001 - 0.05 %, and connected to the anode. A voltage of 120 - 380 V is connected to the system. The aluminium oxide surface which is produced tehereby has a low porosity, about 3 %.

According to another advantageous embodiment of the present invention, the aluminium profile can be surface treated by means of thermic spray coating, such as plasma spray coating or detonation spray coating. By thermic spray coating, powder of metal and/or non-metallic material is converted into molten or plastic condition and sprayed as molten particles onto the surface to be treated. By means of thermic spray treatment, an aluminium profile can be coated with aluminium oxide, chromium oxide, zirconium oxide, aluminium silicate or carbides.

The plasma spray coating process utilizes electric energy, whereas the detonation coating process gets the energy

needed through combustion. In both coating processes the substrate is held at a low temperature, which in plasma spray coating usually is < 300°C and in detonation coating is between 50 to 100°C.

All substrates normally require some kind of pretreatment for good adherence of the coating. A strong adherence between the substrate and a ceramic material is, however, achieved even without a binding intermediate layer. The adherence corresponds to a value of 100 MPa at least.

By thermic spray treatment, a coating having a very low porosity is brought about. The plasma spray coating produces a coating having a porosity of about 3 %, whereas the detonation spray coating produces a coating having a porosity of about 1 %.

The total cost of foils and vacuum box covers produced according to the invention of surface treated aluminium profiles is considerably lower than the total costs of corresponding foils or vacuum box covers made of steel, plastic and ceramic inserts, as shown for instance in the Finnish Patent Application No. 935600. The aluminium profile is as such cheap and the surface treatment makes it durable. The difference in cost is still greater, if a foil according to the invention is compared with a ceramic foil.

Repair of worn profile elements can easily be brought about by spray treatment. A completely worn out aluminium profile is, however, usable and relatively valuable as scrap.

The invention will be described in more detail in the following with reference to the accompanying drawings, in which

FIG. 1 is a schematic view of a foil box with three parallel foils disposed transverse to the direction of the wire, and

FIG. 2 is a schematic, vertical cross-sectional view of

a foil taken in the direction of the wire.

FIG. 1 shows a foil box 10 with three foils 12, 14, and 16 made of extruded aluminium profiles. The foils are disposed transverse to the direction of the wire and attached by means of dovetail profiles to supporting members 18, 20, 22 of steel.

FIG. 2 shows a vertical cross section of a foil 14 made of an extruded aluminium profile 24. The lower portion of the profile is connected to the supporting member 20 by means of a dovetail joint. The wire 26 bears against the upper surface 28 of the foil. The upper surface of the foil has a 50 - 400 μm thick outer layer 30 of oxide, which makes the foil abrasion-resistant and hard.

The invention is not limited to the embodiments described and illustrated above, but can be varied in many ways within the scope and spirit of the invention, which is defined in the appended claims.

CLAIMS

1. An element susceptible to wear, such as a foil or a vacuum box cover for a paper machine, **characterized** in that the element consists of a pressed, extruded or rolled aluminium profile (24).

2. An element susceptible to wear according to claim 1, **characterized** in that the aluminium profile (24) is at least partly coated with a 50 - 400 µm thick layer of aluminium oxide (30), which has been achieved by electrolytic plasma oxidation.

3. An element susceptible to wear according to claim 1, **characterized** in that the aluminium profile (24) is at least partly coated with an oxide layer (30), which has been achieved by plasma or detonation spray coating.

4. An element susceptible to wear according to claim 1, **characterized** in that the aluminium profile is at least partly coated with a surface layer (30) containing chromium oxide, aluminium oxide, zirconium oxide and/or aluminium silicate.

5. A method of manufacturing an element susceptible to wear, such as a foil or a vacuum box cover for a paper machine, **characterized** in that the element is made of a pressed or extruded aluminium profile.

6. A method according to claim 5, **characterized** in that the aluminium profile is coated with a 50 - 400 µm thick layer of aluminium oxide by means of electrolytic plasma oxidation.

7. A method according to claim 5, **characterized** in that the aluminium profile is coated by means of plasma or detonation spray coating with a surface layer containing aluminium oxide, chromium oxide, zirconium oxide and/or

aluminium silicate.

8. A method according to claim 5, **characterized** in that the aluminium profile is coated by means of plasma or detonation spray coating with a surface layer containing carbides.

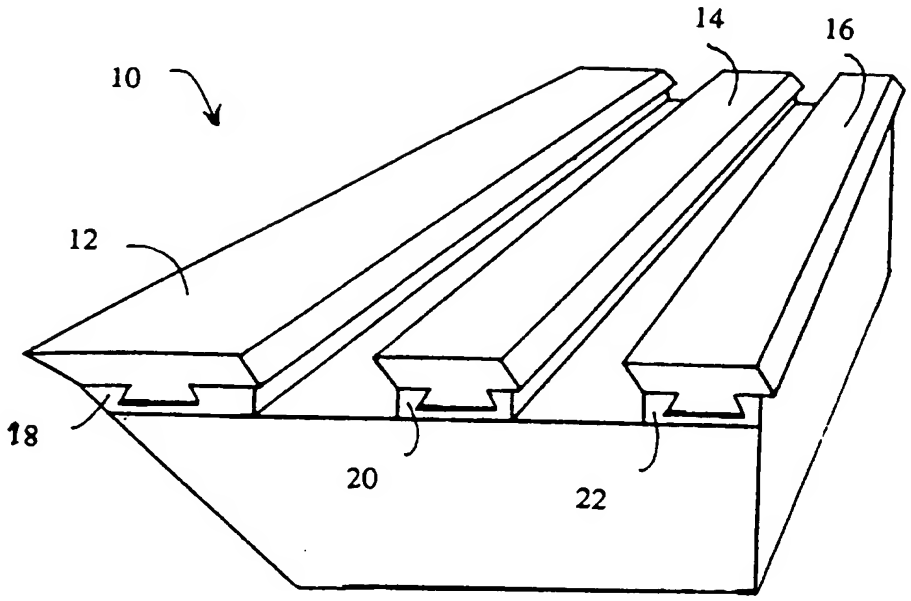

FIG. 1

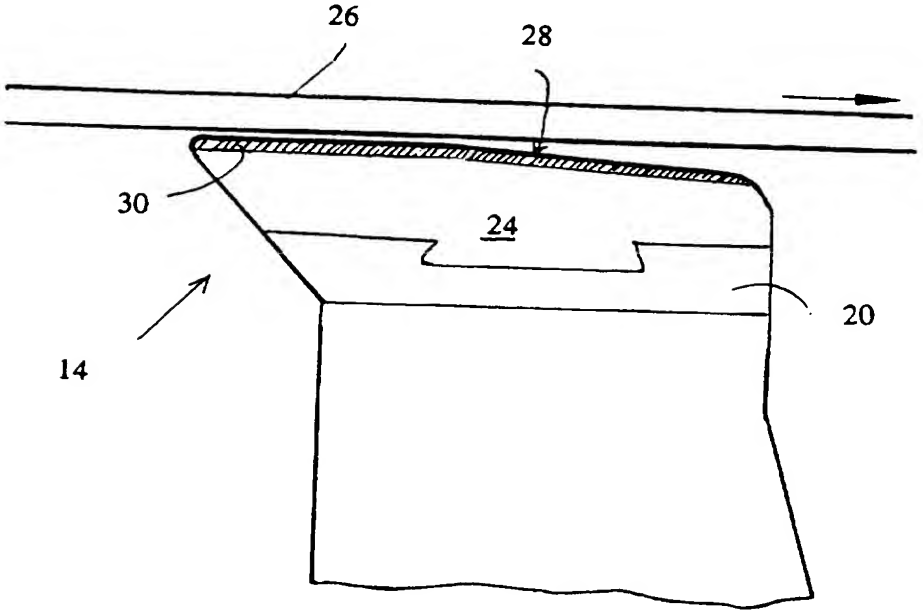

FIG. 2

INTERNATIONAL SEARCH REPORT

Int. ational application No.
PCT/FI 96/00072

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21F 1/48
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG: ALLSCIENCE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SVENSK PAPPERSTIDNING, vol 70, no. 7, 1967, THUNE, "Leverantör av såväl kompletta maskiner som enstaka detaljer", page XXVIII -- --------	1,5

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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